Taking the Inside Outside

With

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“Man its cold”

The benefits and pitfalls of field studies

- The Benefits

  Real hands –on science

Field Testing Techniques

- Students are able to use field procedures that are difficult to utilize in the classroom.

We are able to introduce a variety of subjects; Such as :

- Biological indicators in water quality assessment.

What is a benthic macroinvertebrate?

Benthic: living in or on the stream bottom
Macro: large enough to be seen with the naked eye
Invertebrate: lacking a backbone

- aquatic worms, insects, mollusks, and crustaceans
- live in various habitats such as riffles, leaf packs, snags, sediment and stream banks
- impacted by pollution, habitat changes, and other natural or human-caused changes

Why are they important?

1) Macroinvertebrates serve as a food source for other organisms such as fish and frogs.

1) They break down organic matter and nutrients.

1) Macroinvertebrate diversity is important to sustaining a well balanced freshwater ecosystem.

Taxa 1-The Pollution Intolerant

Stonefly Nymph

Snipefly Larvae

Dobsonfly Larvae

Alderfly Larvae

Taxa 2- Moderately Intolerant to Pollution

Water Penny Beetle

Mayfly Nymph

Riffle Beetle

Clams and Mussels

Crayfish

Dragonfly Nymph

Caddisfly Larvae

Damselfly

Crane Fly Larvae

Taxa 3- Fairly Tolerant To Pollution

Black Fly Larvae

Right handed/other snails

Scud

Sowbug

Midge Larvae

Taxa 4- Pollution Tolerant

Aquatic Worms

Leech

Pouch/Left-handed Snails

Blood Worm Midge Larvae

Procedure for Collecting data

First we grab a kick net or dip net

Then kick or drag the net along the bottom to stir up the bottom.

Then drag net along bottom.

Logan stirring up the bottom and making nice use of his dip net

Then look in the net and see if there are any benthic macroinvertebrates in it.

If so put in a water pan and identify with our taxa information sheets

On the hunt for benthic macs

Chaz checking to see if he had any luck

Example of a scoring chart

- Example

Group 1		group 2		group 3		group 4	
Stonefly	x	caddisfly		blackfly		worms	
Alderfly		mayfly	x	sowbug		leech	
Dobsonfly	x	crane fly		scud	x	midge	
Snipe fly		crayfish					

# of taxa = 2	# taxa 1	# taxa 1	# taxa 0
(x1)= 2	(x2)=2	(x3)=3	(x0)= 0

Total of group score=7

Total of dif taxa 4 7 4= 1.75

Stream assessment quality chart

1-2 excellent water quality

2.1- 2.5 good quality

2.6-3.5 fair water quality

Over 3.5 bad water quality

Forestry

Setting up transect lines

Forestry Transect lines

Collecting soil samples

Tree species identification

Hackberry
Celtis occidentalis

Mockernut Hickory
Carya tomentosa

Black Cherry
Prunus serotina

Slippery Elm
Ulmus rubra

Redbud
Cercis canadensis

Ash
Fraxinus

Chemistry

pH with a pasco probe

Dissolved oxygen with a probe and modified winkler test on samples from discreet depth's collected with a Lamotte water sampler

Students teaching students;

Bio2 students teach bio 1 how to conduct a dissolved oxygen test using a modified winkler test

Testing for Nitrates and Phosphates

Using the DR 820

Dissolved Oxygen

- Dissolved oxygen analysis measures the amount of gaseous oxygen (O_2) dissolved in an aqueous solution. Oxygen gets into water by diffusion from the surrounding air, by aeration (rapid movement), and as a waste product of photosynthesis.

Dissolved Oxygen

- Oxygen dissolves into water from two sources: the atmosphere and from plants in the water. The primary source of oxygen for a pond is from microscopic algae (phytoplankton) or submerged plants. In the presence of sunlight, these produce oxygen through photosynthesis and release this oxygen into the pond water.

Dissolved oxygen

- Adequate dissolved oxygen is necessary for good water quality. Oxygen is a necessary element to all forms of life. Natural stream purification processes require adequate oxygen levels in order to provide for aerobic life forms.

Dissolved Oxygen

- Oxygen depletions are the most common cause of fish kills in ponds. Most oxygen deletions occur in the summer months because 1) warm water holds less dissolved oxygen than cool or cold water, and 2) because the pond's oxygen demand is greater in warm water than in cold water.

Habitat Assessment

- Testing Stream Substrate
- Water odor and color
- Flow rate- Oh No- math
- Stream discharge

Meander

Habitat: Riffle

Habitat: Leaf Pack

Secchi depth- testing for water clarity

Advantages of " outdoor " education

- Provides hands-on, real life learning
- Makes science relevant
- Reaches all learning styles : auditory/visual and tactile
- Can be used at all diverse age levels
- By using students from the advanced classes (bio 2) , students teaching students , peer to peer review is good

Fourth Graders and Freshmen being “taught” by biology 2 students

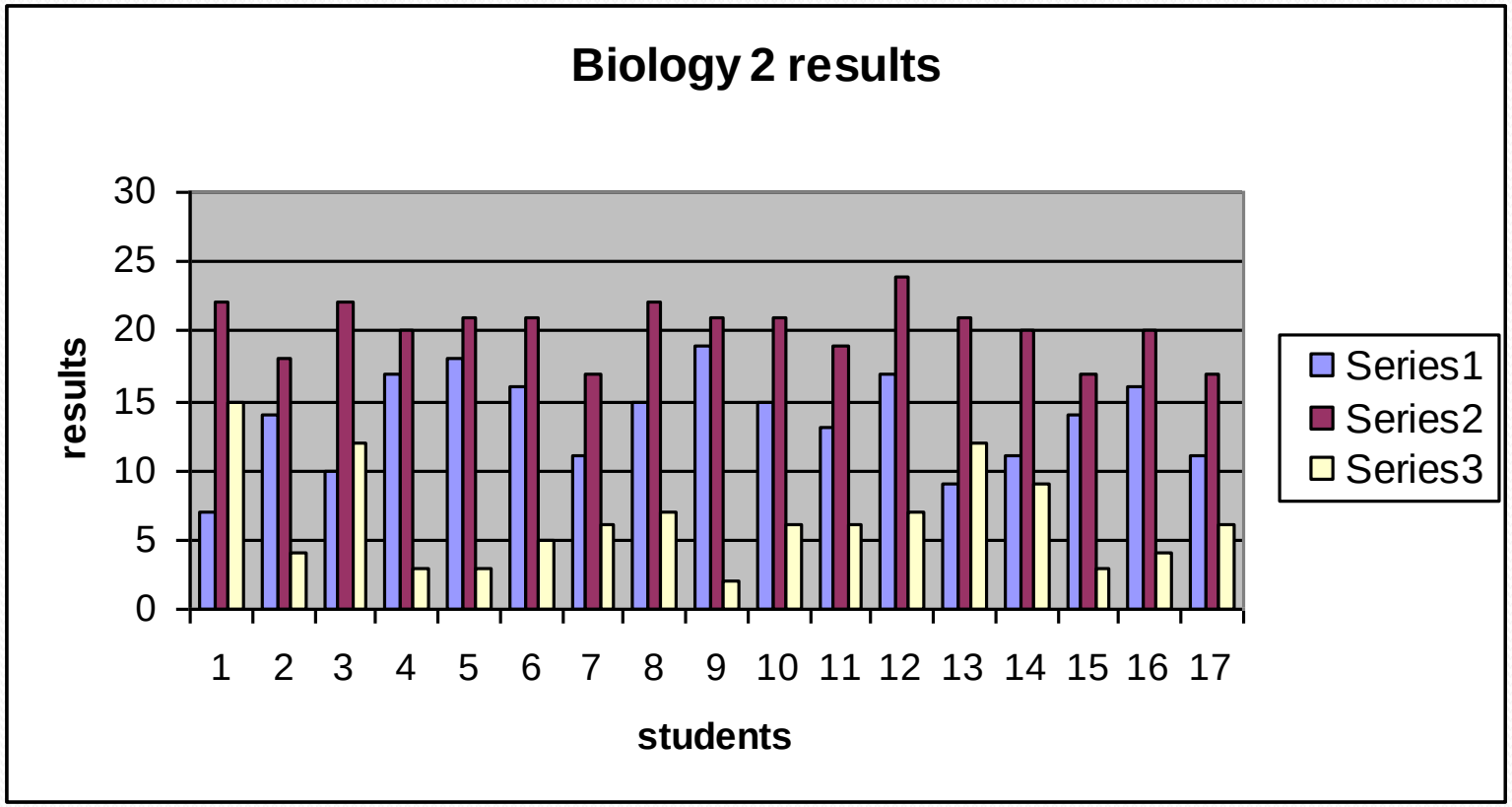
Fourth Graders at Red Hill Lake

“What’s Bugging You?”

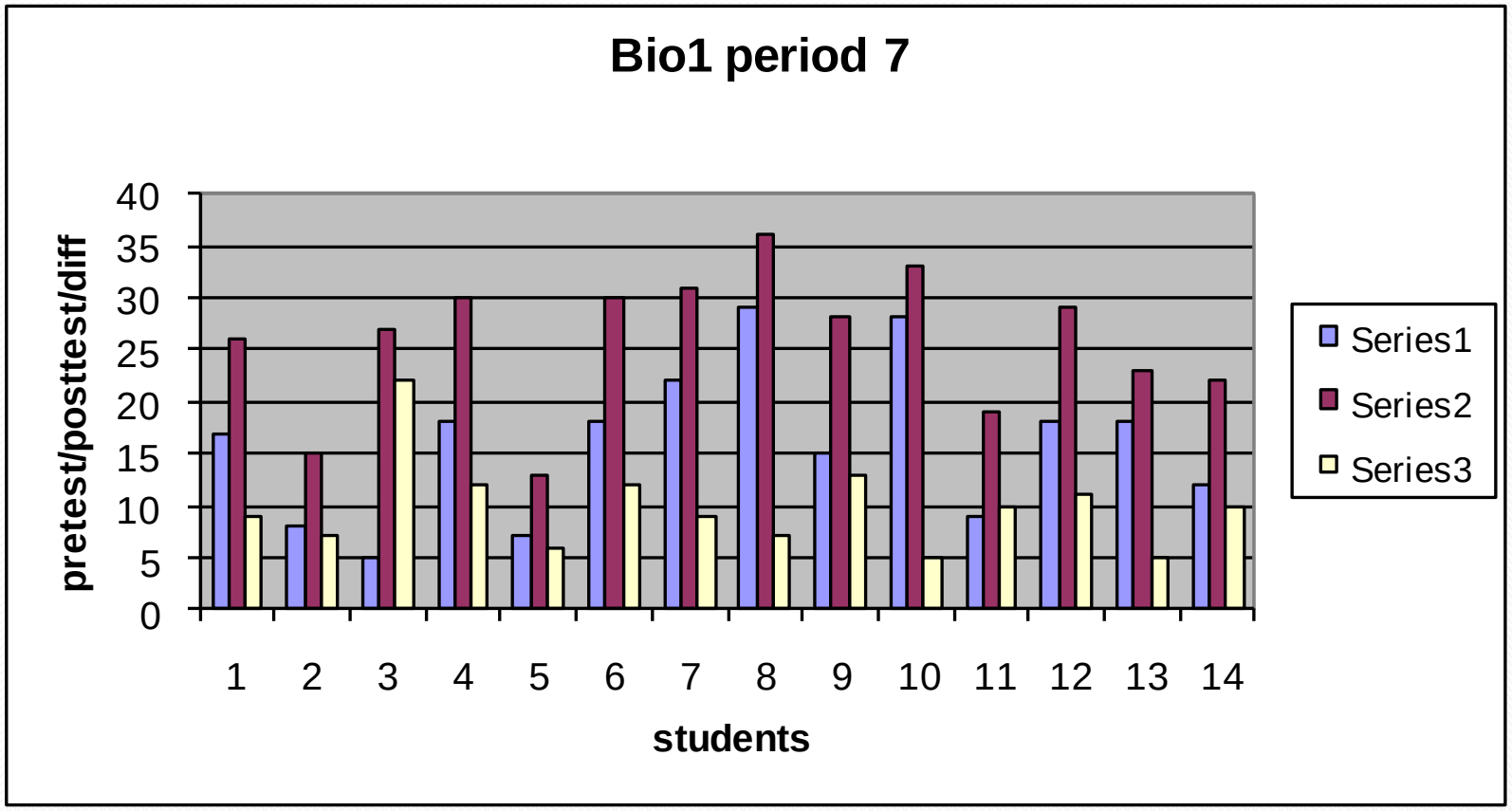
Fourth Graders at the "Chemistry Station"

Getting in touch with the forest

Bio 2 results showing pretest/postest/difference



Biology 1 period 7 results



What do the test results show?

- Almost all students learned- the almost is for the one whose scores went down.
- The better students and the poor students all made gains- which is not as evident in the regular classroom setting

There is more to learning than test results

- All of the station leaders took their responsibilities seriously.
- All students actively participated
- Students were able to learn lots of different science content such as:
- Chemistry- the sources and effects of nitrates and phosphates.

- What dissolved oxygen is, how it gets dissolved and how DO levels impact organisms.

- Biology
- Species identification and taxonomy
  - what biological indicators are and how they are used.
- Forestry- tree identification, DBH, soil pH, canopy cover
- Habitat assessment- how the habitat affects the organisms in it
- Accurate data collection, reporting and interpretation

Math in Science- Oh No

- Measurement and metrics
- Flow rate and stream discharge
- Graphing of dissolved oxygen from discreet depths as collected by the Lamotte Water Sampler based on the Van Dorn Sampler

Additional Learning that Occurred

- Ingenuity
- Leadership
- Cooperation
- Scientific protocols
- The use and care of scientific equipment
- **Learning and Education does not have to be boring or restricted to the four walls of the classroom**

Problems and Pitfalls

- What if the sample area is in flood?

Make do with what you have and do what you can!!!

Problems and Pitfalls

- Equipment malfunctions and chemicals are old.

--- resort to old fashioned manual testing
- explain what to do with bad data

The costs are high

--- our trip was sponsored by the science club
---- equipment was obtained through grants

Problems and Pitfalls

- How do I feed them all?
- Wal-Mart deli subs- relatively cheap and delicious.
  -- Bring their own lunch
- What if I can't take an all day field trip?
  - take a short trip, collect water samples and conduct many of the test in the lab.

Lesson in the Garden

- **Plant**- be willing to take a risk and plant a seed, it might grow , mature and blossom
- **Plan**- A good gardener knows that to produce a pleasing garden, the plan must be made before the first seeds are planted. As the Franklin Life Insurance motto says “no-one plans to fail, we simply fail to plan”
- **Persis**t- just as the gardens are still there, do what you do best, even though the world will change around you.

- **Persevere**- the perennials keep on coming back, even in the face of adversity. The light bulb did not develop overnight- it was a two thousand step process
- **Patience**- it takes time to reap the rewards of the bountiful harvest.
- **Presence**- you must be present. Get out and look for opportunities. Let your presence be known. Don't just vote Present, which is much the same as a no vote.
- **Participate**- be an active participant, not a passive bystander
- **Practice**- a beautiful garden does not just happen, it takes work. In a short period of neglect, what was once an attraction becomes an eyesore.

- **Pull**- yep, there are weeds. If the weeds are not removed, they will soon take away from the beauty. Remember, a weed is just a plant out of place. In spite of what some seem to think, not every plant, or child will achieve if they are in the wrong place. There is a place for everything, sometimes, just not where we think we have to put it. A geranium will never produce roses, and it was not meant to!!
- **Passion**- Be passionate about what you do
- **Pride**. – Develop a sense of pride in what you do